British Journal of Industrial Medicine 1987;**44**:119–123

Occupational risks for renal cancer in Sweden

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ABSTRACT A systematic assessment was made of the occurrence of renal cancer among men by industrial and occupational classification using the Cancer-Environment Registry, which links cancer incidence (1961–79) and census data (1960) with industry and occupation for all employed individuals in Sweden. Data were analysed separately for cancers of the renal parenchyma and pelvis. Significantly increased risks for renal cell cancer were observed for several professional and white collar occupations, including physicians and others in the health care industry. By contrast, the risks for renal pelvis cancer tended to be higher among blue collar workers, especially in the machine industry. Deficits of both cancers occurred among farmers. The findings of the survey are considered as aetiological clues that may deserve further study, although some associations support observations in other countries.

Little is known about the occupational determinants of renal cancer.[1] Raised risks have been reported among coke oven workers,[2] laundry and dry cleaning workers,[3 4] newspaper pressmen,[5] and workers handling asbestos[6] and petroleum, tar, and pitch products.[7 8] Although the data were usually not reported separately by site within the kidney, the vast majority of tumours in these studies arose in the renal parenchyma (renal cell cancer). An excess riskof renal pelvis cancer has been reported for leather workers[9] and a number of workplace exposures associated with bladder cancer.[10] The Swedish Cancer-Environment Registry (CER), which links essentially complete cancer incidence data for 1960–79 with employment data obtained from the 1960 national census,[11] provides a unique opportunity to assess separately the occurrence of renal cell cancer (ICD 7th rev 180·0) and renal pelvis cancer (ICD 180·1) by industry and occupation for an entire country. We report here the results from this hypothesis generating investigation, the first to evaluate systematically occupational risks for renal cancer using large scale population based incidence date. The location of the study is of special interest, since Sweden and other Scandinavian countries have the highest rates of renal cancer in the world.[1]

Methods

A description of the CER and the statistical methods used in calculating the standardised incidence ratios (SIR) have been published before.[1 2] SIRs were calculated for all major (one digit) and general (two digit) industrial and occupational codes. For specific (three digit) employment groups only those with 500 or more individuals were evaluated, as there are over 300 industrial and 300 occupational categories at this level of coding. Few raised risks were observed among employed women; hence only the results for men will be presented (except in those instances where female risks may clarify the observed patterns).

Accepted 6 May 1986

Results

Among Swedish men employed in 1960, there were 7405 cases of renal cell cancer (99% microscopically confirmed) and 821 cases of renal pelvis cancer (98% microscopically confirmed) during the 19 year follow up. Ninety five per cent of the cases of renal cell cancer were adenocarcinomas and 4% unspecified epithelial cancers; 80% of the cases of renal pelvis cancer were transitional cell carcinomas, 5% squamous cell cancer, and 12% unspecified epithelial cancers.

For the major divisions of industry and occupation in Sweden (table 1) the highest risks for the renal cell cancer occurred among professional, technical, and related workers (SIR = 1·20, $p < 0·01$). There were also significantly raised SIRs for the white collar occupations of administrative workers and sales workers, and for the services industry. By contrast, the highest risks for renal pelvis cancer occurred

Table 1 *Standardised incidence ratios (SIR) for renal cell and renal pelvis cancers by major division of industry and occupation among me*

Code	*Major industry*	*Renal cell cancer cases*	*SIR†*	*Renal pelvis cancer cases*	*SIR†*	*Code*	*Major occupation*	*Renal cell cancer cases*	*SIR†*	*Renal pelvis cancer cases*	*SIR†*
0	Farming, forestry, hunting, and fishing	1287	0·88*	105	0·67*	0	Professional, technical, and related workers	995	1·20*	106	1·17
1	Mining and quarrying	56	0·86	8	1·31	1	Administrative, executive, and managerial workers	319	1·14**	29	0·93
2	Manufacturing I	1024	1·01	119	1·05	2	Clerical workers	309	1·08	36	1·13
3	Manufacturing II	1658	1·06*	211	1·22*	3	Sales workers	581	1·14*	64	1·14
4	Construction	983	1·02	113	1·07	4	Farmers, fishermen, hunters, and related workers	1255	0·87*	102	0·66*
5	Electric, gas, water, and sanitary services	131	1·17	13	1·07	5	Miners, quarrymen, and related workers	50	1·04	7	1·45
6	Trade, finance, insurance, real estate	773	1·04	83	1·01	6	Transport and communication workers	532	1·00	55	0·94
7	Transport and communication	606	1·04	71	1·11	7	Craftsmen, production workers, and labourers	2048	1·02	240	1·08
8	Services	868	1·13*	97	1·14	8	Craftsmen, production workers, and labourers, NEC	965	0·94	140	1·22**
9	Non-classifiable services	19	0·85	1	0·41	9	Services, sport, and recreation workers	351	1·08	42	1·18

*p < 0·01; **p < 0·05.
†Adjusted for age and region.
NEC = Not elsewhere classified.

Table 2 *Standardised incidence ratios (SIR) for renal cell and renal pelvis cancers by general (two digit) manufacturing industries and craftsman tradesman occupations among men*

Code	*General industry*	*Renal cell cancer cases*	*SIR†*	*Renal pelvis cancer cases*	*SIR†*	*Code*	*General occupation*	*Renal cell cancer cases*	*SIR†*	*Renal pelvis cancer cases*	*SIR†*
20	Food products	167	0·92	29	1·41	70	Spinners, weavers, and knitters	57	1·24	3	0·63
21	Tobacco and beverages	29	0·89	4	1·08	71	Tailors, cutters, furriers	45	0·79	7	1·12
22	Textile	100	1·11	8	0·84	72	Shoe and leather workers	46	1·06	5	1·07
23	Apparel	110	0·97	15	1·25	73	Metal making and treating workers	137	0·96	20	1·34
24	Lumber and wood products	215	1·04	16	0·70	74	Precision instrument makers	35	1·07	4	1·11
25	Furniture and fixtures	59	0·86	8	0·94	75	Toolmakers, machinists, plumbers, welders	699	1·07	95	1·31**
26	Paper and allied products	202	1·07	23	1·12	76	Electricians, electronic workers	173	1·08	22	1·29
27	Printing and publishing	125	1·02	14	1·02	77	Woodworkers	452	1·02	37	0·75
28	Leather	17	1·15	2	1·23	78	Painters, paperhangers	124	0·94	10	0·69
30	Rubber	28	0·95	4	1·10	79	Bricklayer and construction worker, NEC	280	0·90	37	1·08
31	Chemical	92	1·07	7	0·74	80	Graphical worker	55	0·84	11	1·50
32	Coal and petroleum refining	12	0·77	2	1·16	81	Potters, kilnmen, and glass workers	24	0·73	8	2·12
33	Stone, clay, glass	113	0·86	16	1·10	82	Food industry worker's	108	0·95	16	1·25
34	Fabricated metal products	398	0·99	49	1·17	83	Chemical and cellulose workers	107	0·96	14	1·15
35	Machinery and electronics	611	1·14*	85	1·42*	84	Tobacco workers	0	—	0	—
36	Transportation equipment	335	1·10	34	0·98	85	Craftsmen & production process workers	77	0·95	10	1·09
37	Miscellaneous manufacturing	67	1·19	14	2·15**	86	Labourers, NEC	191	0·83	25	0·99
39	Manufacturing, NEC	2	0·76	0	—	87	Stationary engine and equipment operators	170	1·15	17	1·07
40	Home building construction	508	1·02	52	0·95	88	Stationary engine and equipment operator	233	0·93	39	1·38
41	Other construction	475	1·02	61	1·20						

*p < 0·01; **p < 0·05.
†Adjusted for age and region.
NEC = Not elsewhere classified.

Table 3 *Statistically significant ($p < 0.05$) standardised incidence ratios (SIR) for renal cell and renal pelvis cancers for specific (three digit) industries and occupation among men*

Code	*Specific industry*	*Cases*	*SIR†*	*Code*	*Specific occupation*	*Cases*	*SIR†*
				Renal cell cancer			
015	Veterinary medicine	7	2·59	006	Engineers and technicians in other technical fields	80	1·28
220	Wool industry	33	1·61	031	Physicians	33	1·48
350	Machine industry	435	1·13	054	Teachers of practical subjects	21	1·71
352	Other electronics industry	165	1·20	085	Journalists and editors	34	1·88*
362	Railroad and trolley works	48	1·45	111	Business executives	201	1·23*
412	Building sheetmetal construction	20	1·79	294	Dispatchers and shipping agents	28	1·99*
702	Automobile transportation	65	1·33	313	Advertisers	13	1·98
804	Police work	45	1·45	755	Welders and metal cutters	71	1·31
				902	Police	41	1·52
820	Health care	103	1·28	981	Military service	52	1·35
851	Fine arts and music composition	20	1·75				
853	Theatres	11	2·14				
				Renal pelvis cancer			
102	Other ore mining	4	4·49	005	Engineers and technicians in mining and metallurgy	6	3·29
350	Machine industry	70	1·60*	071	Judges	5	9·16*
370	Scientific and surgical instrument construction	6	5·18*	331	Wholesale buyers	19	1·91
413	Plumbing installation	18	2·37*	750	Machinists and toolmakers	31	1·52
802	Legal services	7	4·67*	754	Plumbers	15	2·17
853	Theatres	3	5·23				

*$p < 0.01$.
†Adjusted for age and region.

among blue collar occupations (craftsmen, production workers, and labourers, SIR = 1·22, $p < 0.05$) and for mining and manufacturing industries, although non-significantly raised SIRs were seen among professional and service workers. For both renal cell and renal pelvis cancers, significantly decreased SIRs were found among farmers, forestry, fishing, and related workers.

Because previous clues to occupational factors centered on jobs and exposures in manufacturing, SIRs were calculated for all general (two digit) manufacturing industries and craftsman tradesman occupations (table 2). Significantly raised risks for both cancers were seen for men in the machinery and electronics industry. SIRs exceeding 1·0 were more often observed for renal pelvis cancer, however, with the excesses being significant among those employed in miscellaneous manufacturing, and as toolmakers, machinists, plumbers, and welders.

Table 3 (top panel) shows in which specific (three digit) industries and occupations there are significantly raised ($p < 0.05$) SIRs associated with renal cell cancer. Several health related professions and the health care industry appear to have a raised risk for renal cell cancer. A significantly high SIR was found for physicians and the risk for dentists was also raised (SIR = 1·62; 20 cases) and of borderline statistical significance ($p = 0.06$). For the general (two digit) occupation of medical professionals, which combines physicians and dentists, the SIR was increased and highly significant (SIR = 1·53; 53 cases; $p < 0.01$). Most of the other occupations with raised SIRs were white collar professions. The bottom panel of table 3 shows specific industries and occupations with significantly raised SIRs for renal pelvis cancer. SIRs for this cancer were generally higher than those for renal cell cancer, although based on many fewer observations.

Discussion

This hypothesis generating study showed several statistically significant occupational associations for cancers of the renal parenchyma and renal pelvis. In general, the occupational patterns of renal cell cancer differed from those of renal pelvis cancer. The SIRs for renal cell cancer tended to be high among white collar workers whereas the SIRs for renal pelvis cancer were generally higher among blue collar employees.

The increased risk of renal cell cancer among health professionals (physicians, dentists, and veterinary surgeons) is consistent with findings from a recent occupational mortality analysis in the United States.[13] It is not clear whether this association reflects occupational exposures or, perhaps more likely, lifestyle risk factors for this cancer, including smoking habits, body weight, meat and fat consumption, analgesic use, or diagnostic surveillance.[8 14 15] Tobacco smoking appears an unlikely

explanation, however, since smoking rates for Swedish health professionals in 1963 were comparable with those for the general population (J Carstensen, personal communication). The high rates observed among welders, military personnel, journalists and editors, and dispatchers and shipping agents, have been reported in previous occupational surveys.[16-18]

Some occupational categories have been previously linked to renal cell cancer but did not emerge as high risk groups in the present survey. For example, the raised risk observed among coke oven workers in the United States[2] was not detected in the categories of iron and steel making (SIR = 0·98; 145 cases) or hearth and furnace workers (SIR = 0·94; 7 cases), although no specific code exists for coke oven workers. The SIRs for the laundry and dry cleaning industry were 0·99 (18 cases) among men and 0·86 (25 cases) among women, indicating no increased risk such as has been observed in the United States.[3,4] Unlike previous reports,[5-7] we found no excess risk among printing or graphical workers (SIR = 0·83; 47 cases), insulation workers (SIR = 0·98; 2 cases), or among workers in petroleum refineries (SIR = 0·92; 8 cases) or gasoline stations (SIR = 0·59; 9 cases).

Our earlier communication on kidney cancer reported excesses of renal cell cancer among tanners and of renal pelvis cancer among shoe factory workers between 1961 and 1973.[19] With the longer period of follow up, these associations persisted but were no longer statistically significant among tanners (SIR = 1·56; 9 cases) or shoe factory workers (SIR = 2·68; 4 cases). The inclusion of women in the latter category, however, did result in a significant association (SIR = 2·82; 6 cases). This appears consistent with a case-control study indicating that leather workers are prone to renal pelvis cancer.[9] The significantly raised SIRs among machinists and toolmakers, plumbers, and workers in the machine industry are new aetiological leads, although machinists and plumbers are reported to be at increased risk of bladder cancer,[20] a tumour with risk factors resembling those of renal pelvis cancer.[1]

Although this record linkage study may provide occupational clues to the origins of renal cancer, the CER has limitations that preclude making causal inferences.[12] For example, there is no information on the duration of employment or on non-occupational factors that may influence the risk of renal cancer. Since the effect of cigarette smoking appears greater for renal pelvis cancer[10] than renal cell cancer,[8] occupational differences in smoking prevalence would more likely influence the associations with renal pelvis cancer. The 1963 survey of smoking habits in Sweden found similar proportions of smokers in both blue collar (exclusive of agricultural jobs) and white collar workers.[21] The prevalence of smoking, however, was higher among individuals in the specific occupations of toolmakers and machinists (59% smokers) and plumbers (57% smokers) than among the general male population (46% smokers) (J Carstensen, personal communication). Smoking may thus partly account for the excess risks associated with these job categories. Smoking may also contribute to the deficit of both cancers (most pronounced for renal pelvis cancer) among farmers, since as a group, farmers smoke less.[21] The multiple comparisons made in this study also affect the interpretation of the findings, since there were few a priori leads and a large number of employment categories were reviewed. It is difficult to know, therefore, whether to place much credibility in statistically significant associations for specific (three digit) industries or occupations when almost 800 such categories were studied for the two cancers, and many associations are expected on the basis of chance alone. It is noteworthy, however, that several findings of our survey are consistent with previously reported associations for renal cancer.

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